



## Detection of Heavy Metals in the Selected Edible Fish species from Baran Dam f. R Bannu Pakistan

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### ABSTRACT

The objective of the research work was to determine the distributed level of Heavy metals like Copper (Cu), Zink (Zn). Iron (Fe), Lead (Pb) and Chromium (Cr) in the month of January - February 2013 at Baran Dam F.R Bannu. The recorded level of the values of all heavy metals in head, abdomen and tail in *Labeocalbasu* were Cr>Fe>Cu>Zn>Pb, Cu>Cr>Zn>Pb, Cr>Fe>Cu>Zn>Pb, in *Labeoboga* were Zn>Cr>Fe >Pb>Cu, Cr>Zn>Cu>Fe>Pb, Fe>Cr>Cu>Zn>Pb, in *Notopterusnotopterus* were Cr>Fe>Zn>Cu>Pb, Cu>Fe>Cr>Zn>Pb, Fe>Cu>Cr>Zn>Pb, in *Mastacembelusarmtus* were Fe>Cu>Cr>Zn>Pb, Cr>Cu>Fe>Zn>Pb, Cr>Zn>Cu>Pb respectively. It indicate that Pb have the lowest concentration in all the organ of above except in head of *Labeoboga* fish species. Chromium was found unexpectedly in high amounts but its consumption limits were not set down yet in *Labeocalbasu*. The mean value for heavy metals were Zn ( $P < 0.1017$ )  $\text{mgKg}^{-1}$ , Fe ( $P < 0.5065$ )  $\text{mgKg}^{-1}$ , Cu ( $P < 0.7221$ )  $\text{mgKg}^{-1}$ , Pb ( $P < 0.6553$ )  $\text{mgKg}^{-1}$ , and Cr ( $P > 0.0003$ )  $\text{mgKg}^{-1}$  in fish size (both weight and length), respectively in all the four fish species.

**Keyword:** Baran Dam F.R Bannu , Heavy metals, *Labeoboga*, *Labeocalbasu*.

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## INTRODUCTION

The term heavy metals is a general collective term which applies to group of metals and metalloids with atomic density greater than water they are also known as trace elements because they occur in minute concentrations in biological systems. The eight most common pollutant heavy metals listed by the, EPA (Environment Protection Agency) are As, Cd, Cr, Cu, Hg, Ni, Pb, and Zn Athar and Vohora, 2001.<sup>1</sup>

The growing human population has increased the need for food supply. Because they are good protein sources, the demand for fish and shellfish products has increased. Worldwide, people obtain about 25% of their animal protein from fish and shellfish *Bahnasawy et al., 2009.*<sup>2</sup> It has been predicted that fish consumption in developing countries will increase by 57 percent, from 62.7 million tons in 1997 to 98.6million in 2020. Aquatic organisms, such as fish, accumulate pollutants directly from contaminated water and indirectly via the food chain. Application of chemical fertilizers containing trace of heavy metals causes contamination of fish with these metals. The effects of pesticides either organ phosphorous or chlorinated pesticides have been extensively studied and confirmed in fish. The impact of toxic materials on the integrity and functioning of DNA has been investigated Sun et al., 2010.<sup>3</sup> Fishes are major part of the human diet and it is therefore not surprising that numerous studies have been carried out on metal pollution in different species of edible fish. Predominantly, fish toxicological and environmental studies have prompted interest in the determination of toxic elements in seafood *Dobaradarna et al.,2002.*<sup>4</sup>Metals entering the aquatic ecosystem can be deposited in aquatic organisms through the effects of bio concentration, bioaccumulation via the food chain process and become toxic when accumulation reaches a substantially high level

The purpose of the present study was to determine the presence of heavy metals contaminants like iron (Fe), copper(Cu), chromium (Cr), lead (Pb) and zinc (Zn) in the head, tail and abdomen in the fish species found in Baran Dam F.R Bannu.

## MATERIALS AND METHOD

### Study Area

The sampling location for this study was at Baran Dam in Bannu district of Khyber Pakhtunkhwa Province Pakistan. It branches off into two canals in district Bannu .One, the Katchkot canal irrigating the region of district Bannu, the other one irrigating F.R Bannu and LakkiMarwat regions. The principal source of water is local run-off, with the main flooding occurring in spring. Baran Dam (33°02'N, 70°33'E) is a flood control dam and water storage

reservoir near the Kurram River about ten km west of Bannu. Baran Dam is used for the generation of electricity, as a water supply for irrigation, and for fishing, common fishes occurring in Baran Dam include *Tor tor*, *Cyprinus carpio*, *Cirrhinus mrigala*, *Labeo rohita* and *Catla catla*. Some other fishes are present in the Baran Dam but these have not been studied.

### **The Baran Storage Reservoir**

The reservoir site is at debouchments of Baran River which has a catchment of 154 squares miles and the maximum record flood of 40000 cusecs. The reservoir is connected with Kurram River through Baran feeder channel and the upper main canal. The capacity of these two channels is 3000 cusecs. Surplus water from the Kurram River can be fed into Baran reservoir when supplies are available. The requirement of katchkot canals on which the hydal falls situated is 600 cusecs. The right bank canal which takes 800 Cusecs will be supplied from the river Kurram when water is available and during short supplies in river the supply in the canal will be supplemented through an intake from the baran storage reservoir. The reservoir has a capacity of 87000 acre ft; the dam is, 112 ft high and 3200 ft long at the top.

Baran Dam is one of the home of five known Fish species including *Tor tor*, *Cirrhinus mrigala*, *Labeo rohita*, *Cyprinus carpio* and *Catla catla*. We selected Baran Dam as our sampling location because it was downstream from various industrial and domestic location effluent discharge sites. Hence one would expect it to be a more polluted segment of river Kurram.

### **Sampling Location**

Fish samples were collected in between January and February 2013 from various stations (region of inlet, middle and outlet water flow in Baran dam FR Bannu region). There are four fish samples from each kind of fish species were collected from Baran dam in FR Bannu region. Samples selected for analysis were, Kalbance (*Labeo calbasu*), Bhangor (*Labeo boga*), Jalabi (*Notopterus notopterus*) and Bam (*Mastacembelus armatus*) were collected from Baran Dam F.R Bannu district with the help of hand net and cast nets in between January and February 2013. The collected fish samples were packed in plastic container and transported to the department of chemistry Kohat University of Science and Technology (KUST), Kohat for further studies. The samples were placed in sterile polythene bags and kept in the laboratory deep freezer (-20°C) to prevent deterioration till further analysis.

### **Sample Preparation**

Dry method was adopted for sample preparation and prepared sample of fish organs viz. head, tail and abdomen. A clean washed high quality corrosion resistant stainless knife was used to cut the fish into head, tail and abdomen. These samples were placed in Oven for two hours at 110c<sup>0</sup>

for moisture absorption. 2g of completely dried homogenized fish samples were weighed accurately in crucible for each sample. The samples were placed in incubator for 2 hour to become ash. They were cooled and 10ml of concentrated HNO<sub>3</sub> was added into each Crucible. The samples in Crucible were heated on a hot plate for half an hour to evaporate excess amount of HNO<sub>3</sub> and the solution was evaporated again on a hot plate, continuing until sample was completely digested and become colorless. The sample was cooled to room temperature. The digested sample was filtered through Whatman filter paper no. 42 into 25 ml Graduated cylinder and made up to the volume using HPLC grade water. Ali Rehman et, al IJSID 2013.<sup>5</sup>

## RESULTS AND DISCUSSTION

Fish species	Heavy metals concentration (mg Kg <sup>-1</sup> )														
	Head					Abdomen					Tail				
	Pb	Fe	Zn	Cr	C	Pb	Fe	Zn	Cr	Cu	Pb	Fe	Zn	Cr	Cu
<i>Labeocalbasu</i>	0.12	10.32	2.3	12.18	6.7	0.638	ND	2.05	12.07	3.06	0.28	9.66	1.9	12.7	4.2
<i>Labeoboga</i>	0.22	1.097	7.8	7.02	0.11	3.98	4.25	5.85	4.09	0.14	9.39	3.76	8.34	4.9	
<i>Notopterusnotopterus</i>	0.5	7.821	4.05	8.54	3.9	0.162	6.54	2.88	5.01	8.2	0.05	16.88	1.57	2.3	04
<i>Mastacembelusarmtus</i>	0.16	13.02	4.5	5.13	5.2	0.168	4.846	3.3	6.33	6.03	0.23	ND	2.33	3.5	1.19

Concentration of heavy metals in fish species selected from Baran Dam Bannu

Figure. 1 represents the level of five selected heavy metals (Pb, Fe, Zn, Cr and Cu) in the fish species of Baran Dam, in which the Iron have the highest level in all metals in the tail of *Notopterusnotopterus*. The recorded level of the values of all heavy metals in head, abdomen and tail of *Labeocalbasu* are Cr>Fe>Cu>Zn>Pb, Cu>Cr>Zn>Pb, and Cr>Fe>Cu>Zn>Pb, in *Labeoboga* are Zn>Cr>Fe >Pb>Cu, Cr>Zn>Cu>Fe>Pb, and Fe>Cr>Cu>Zn>Pb, in *Notopterusnotopterus* are Cr>Fe>Zn>Cu>Pb, Cu>Fe>Cr>Zn>Pb, and Fe>Cu>Cr>Zn>Pb, in *Mastacembelusarmtus* are Fe>Cu>Cr>Zn>Pb, Cr>Cu>Fe>Zn>Pb, and Cr>Zn>Cu>Pb respectively.

Analysis of variance showed no significant differences (P>0.05) for heavy metals concentration among different fish species

Figure. 2 indicate the level of lead in different fish species found in Baran Dam Bannu, which identify that the highest level of lead found in the abdomen of *Labeocalbasu*, while the lowest value of lead found in the tail of *Notopterusnotopterus* fish species.

Analysis of variance showed no significant differences ( $P>0.05$ ) for Pb concentration among different fish species

Figure. 3 point out the level of iron in different fish species found in Baran Dam Bannu. Which identify that the highest level of iron found in the tail of *notoperusnotoperus*, while the lowest value of leads found in the head of *Labeoboga* fish species.

Analysis of variance showed significant differences ( $P<0.05$ ) for Fe concentration among different fish species.

Figure. 4 reveals the levels of Zinc heavy metal in the different body parts of the selected fish species living in the baran Dam DistricBannu. The above graph shows that highest level of Zinc present in the head of *Labeoboga* fish species, while the lowest level recorded in the tail of *Notopterusnotopterus* fish species.

Analysis of variance showed no significant differences ( $P>0.05$ ) for heavy metals concentration among different fish species.

Figure. 5 illustrates the level of Copper found in the abovefourfish species. Clearly indicate that the highest value of Copper present in the abdomen of *Notopterusnotopterus* fish, while the lowest value recorded in the head of *Labeoboga* fish species.

Analysis of variance showed no significant differences ( $P>0.05$ ) for heavy metals concentration among different fish species.

Figure. 6 represents different values of Cr in fish species, in which the tail of Labeocal basu have the highest value and the tail of *Notopterusnotopterus* have the lowest value found in Baran Dam District Bannu.

Analysis of variance showed no significant differences ( $P>0.05$ ) for heavy metals concentration among different fish species.

Knowledge of heavy metal concentrations in fish is important with respect to nature of management and human consumption of fish. In the literature, heavy metal concentrations in the tissue of freshwater fish Vary considerably among different studies Chattopadhyay et al., 2002.<sup>6</sup> Papagiannis et al., 2004.<sup>7</sup> possibly due to differences in metal concentrations and chemical characteristics of water from which fish were sampled, ecological needs, metabolism and feeding patterns of fish and also the season in which studies were carried out. In the dam, fish are often at the top of the food chain and have the tendency to concentrate heavy metals from water. Therefore, bioaccumulation of metals in fish can be considered as an index of metal pollution in the aquatic bodies Tawari-Fufeyin and Ekaye, 2007.<sup>8</sup> that could be a useful tool to study the biological role of metals present at higher concern- tractions in fish Dural et al., 2007.<sup>8</sup>

In the present study, the fishes at Baran Dam showed higher accumulation of Iron in their bodies than other four metals in the tail of fish (*Notopterusnotopterus*) at Baran Dam. Metal accumulations in fish bodies appear as site specific, corresponding with the metallic toxicity of three aquatic components viz. water, plankton and sediments. The head and tail of *Labeocalbasu* exhibited highest tendency to accumulate Chromium than other metals as in the order of Cr>Fe>Cu>Zn>Pb and Cr>Fe>Cu>Zn>Pb while *Mastacembelusarmtus* in the abdomen and tail in the order of Cr>Cu>Fe>Zn>Pb, Cr>Zn>Cu>Pb.

Lead has the lowest value in the tail of all above except in head of *Labeoboga*. Dural et al.,2007.<sup>9</sup> reported highest levels of zinc and iron in the tail and head of fish species, our present investigation of zinc value recorded in *Notopterusnotopterus*, *Mastacembelusarmtus* were comparable to the finding of (Dural et al., 2007). Yilmaz et al., 2007.<sup>10</sup> Reported copper accumulations in the head and abdomen were maximum, our recorded value in the abdomen of *Notopterusnotopterus* and *Labeocalbasu* were in the range of Yilmaz finding. The higher levels of trace elements such as chromium in head region of *Notopterusnotopterus* and *Labeocalbasu* are higher relative to other organ while iron in the tail of *Labeoboga* and *Notopterusnotopterus* are due to the great affinity or strong coordination of metal the one protein with these elements in the head region Ikem et al., 2003.<sup>11</sup>

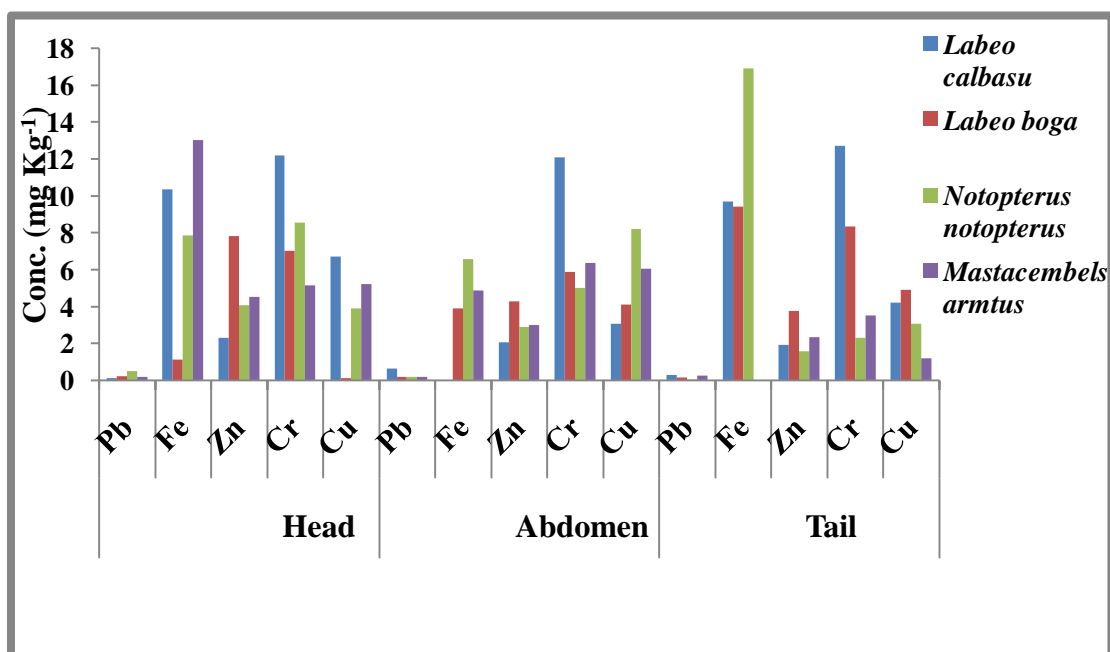


Figure 1. Concentration of heavy metals in fish species selected from Baran Dam Bannu

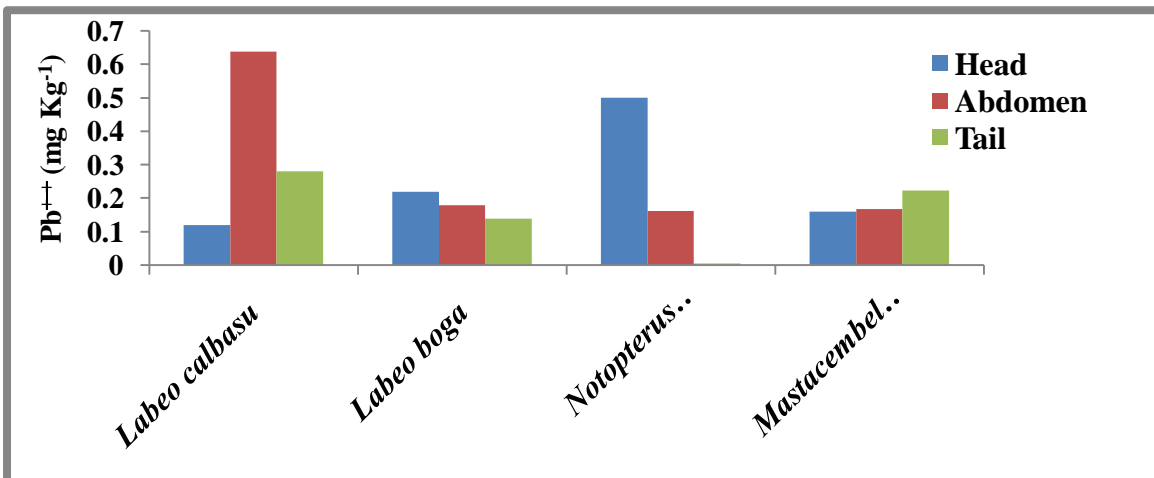


Figure 2. Concentration of Pb in fish selected from Baran Dam Bannu

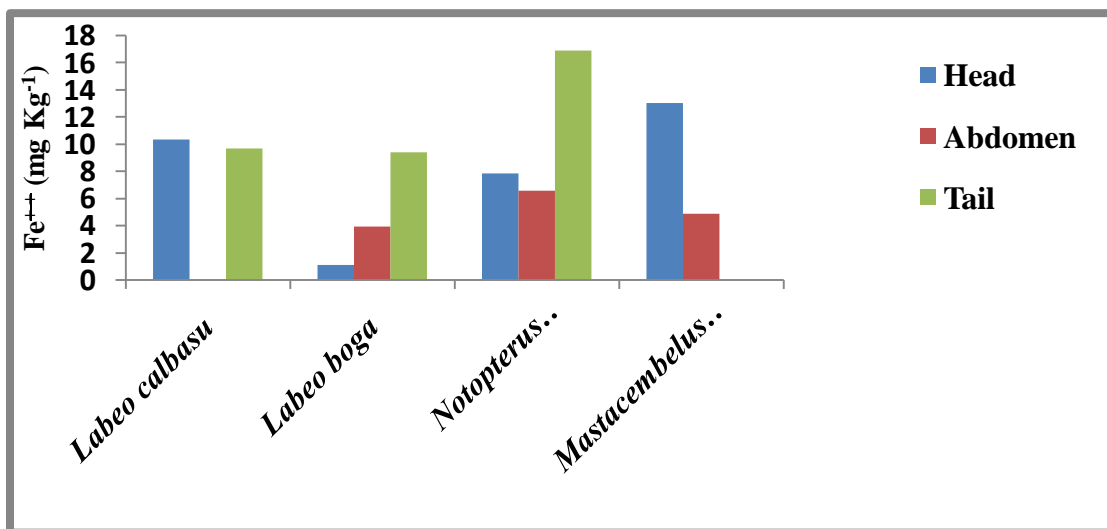


Figure 3. Concentration of Fe in fish species selected from Baran Dam Bannu

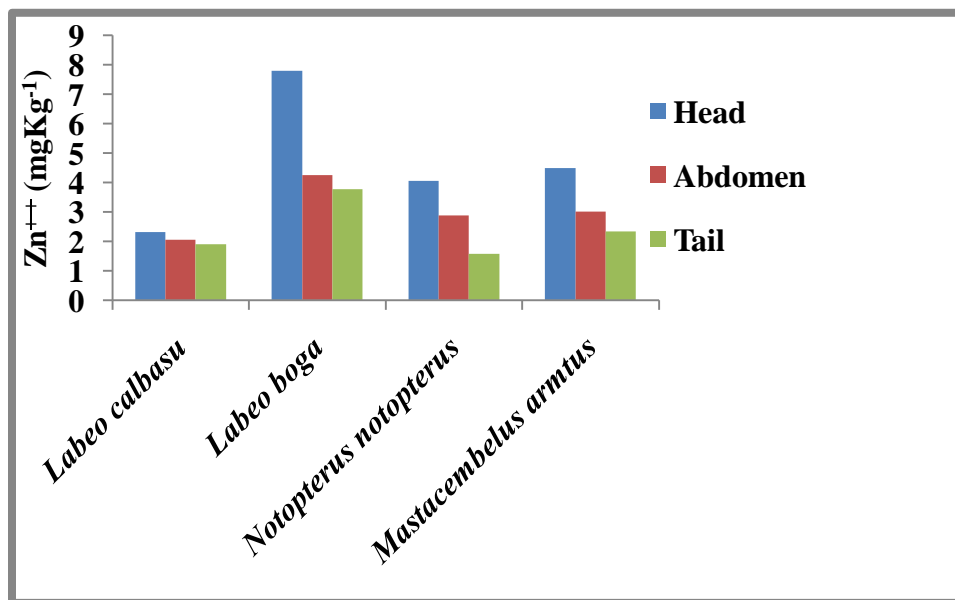


Figure 4. Concentration of Zn in fish species selected from Baran Dam Bannu

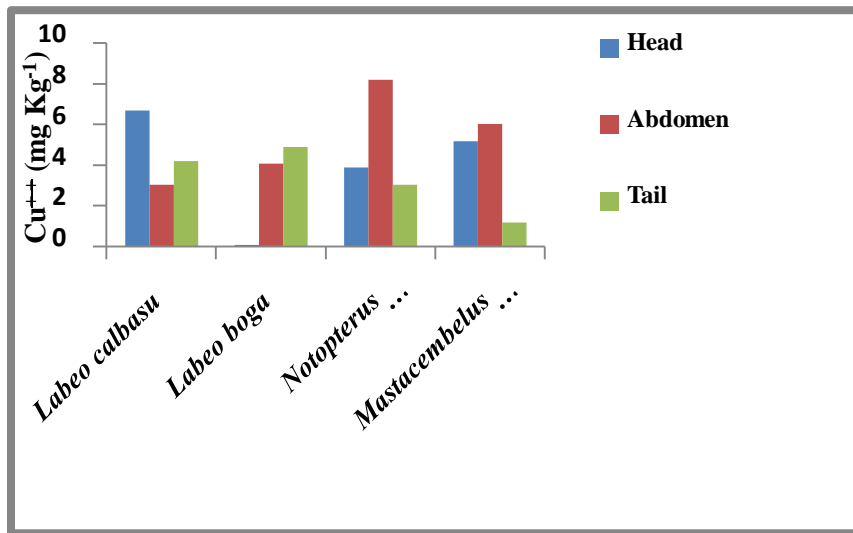


Figure 5. Mean concentration of Cu in fish species selected from Baran Dam Bannu

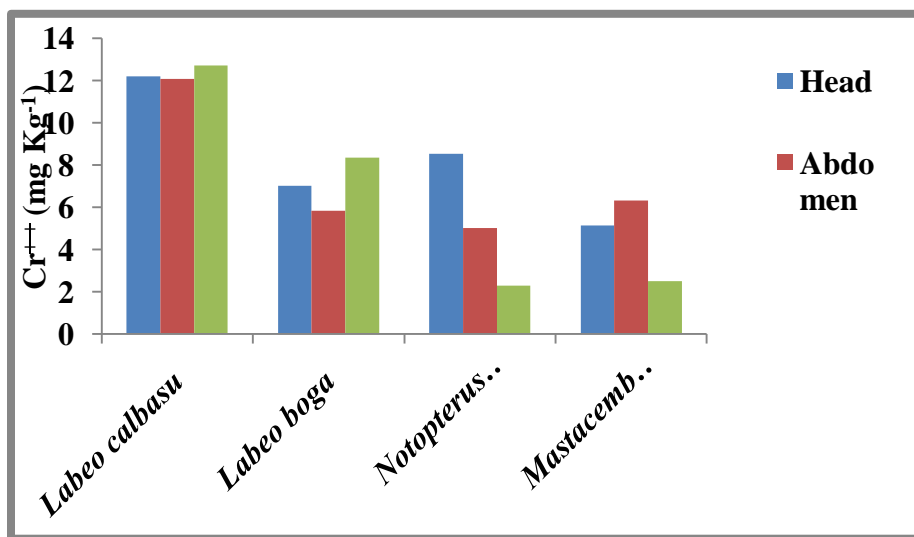
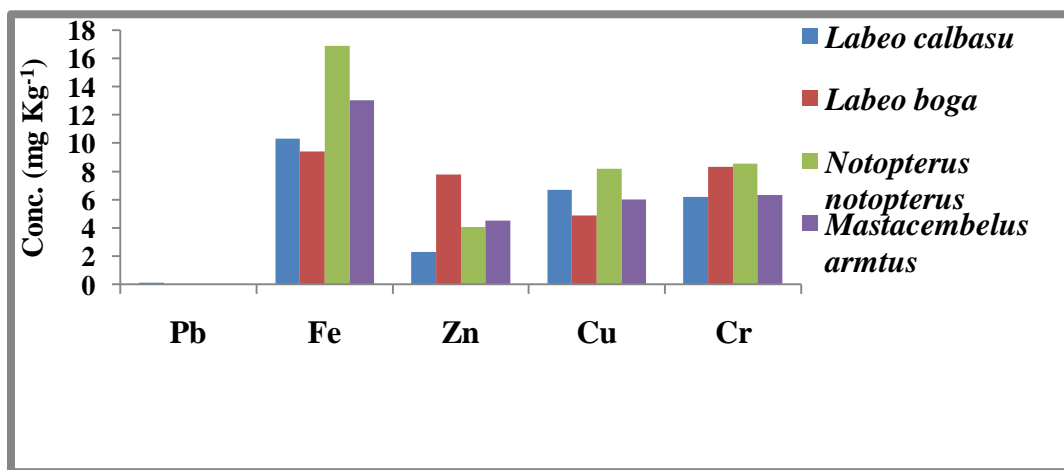
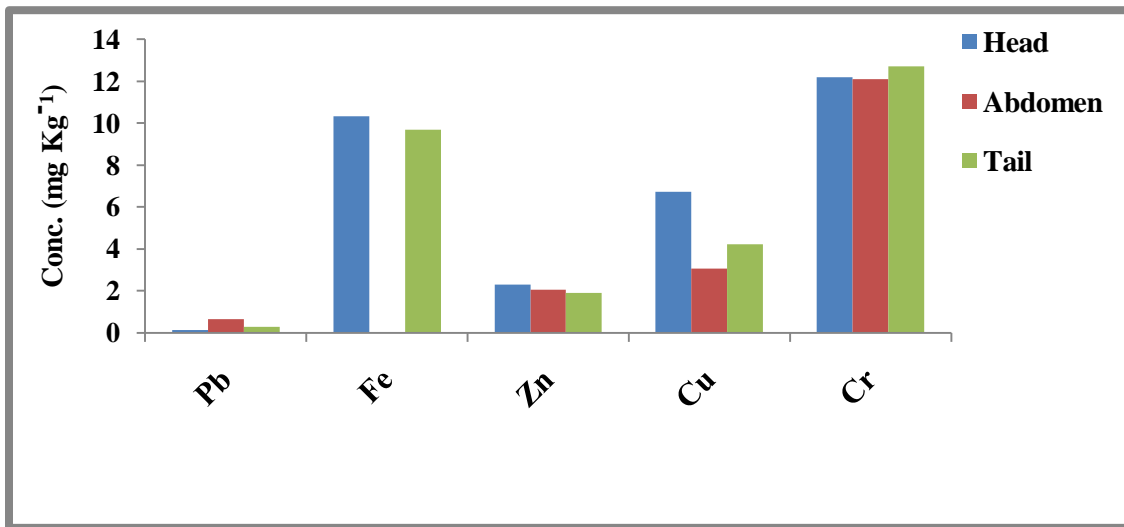


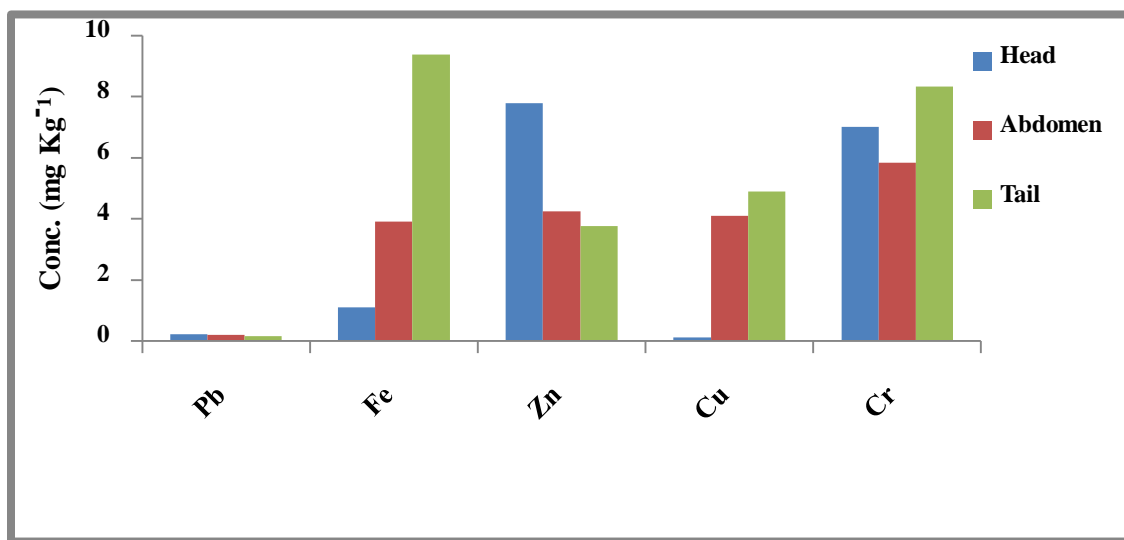
Figure. 6 Concentration of Cr in fish species selected from Baran Dam Bannu



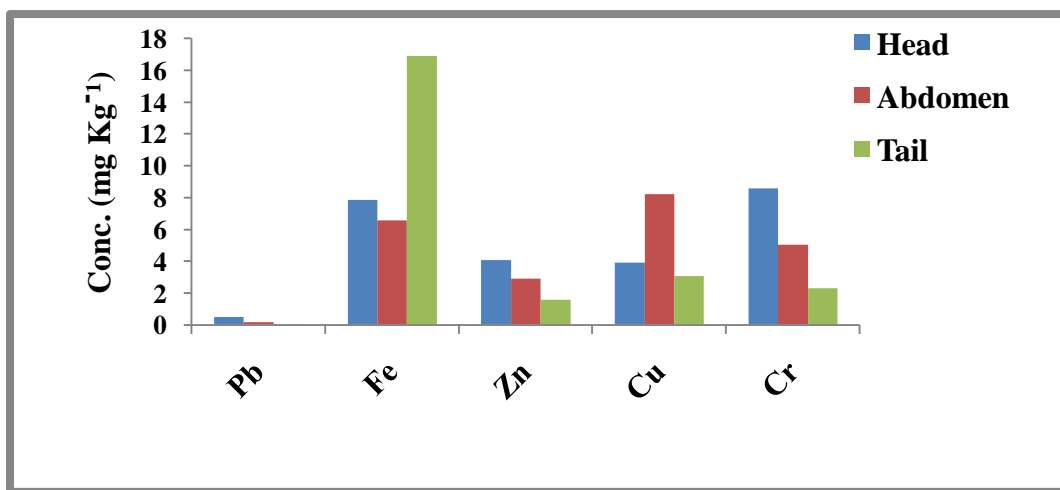
Comparison of the maximum total body (Heavy metal) concentration detected in each fish species



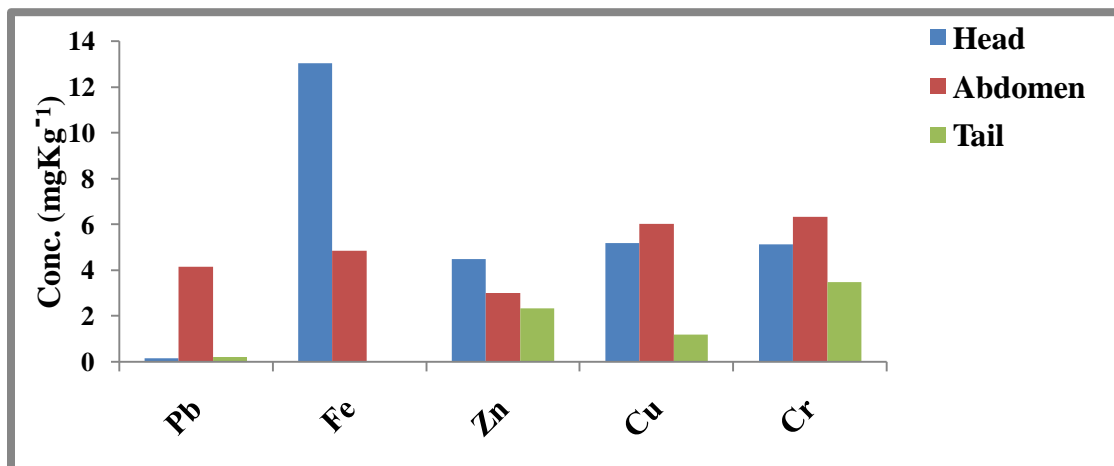
Heavy metals Concentration in *Labeocalbasu* specie selected from Baran Dam Bannu



Heavy metals concentration in *Labeoboga* species selected from Baran Dam Bannu.



Heavy metals Concentration in *Notopterusnotopterus* species selected from Baran Dam Bannu.



### Heavy metals concentration in *Mastacembelusarmtus* species selected from Baran Dam Bannu

#### CONCLUSION

The present study clearly indicated the accumulation of heavy metals in the organs of the four fish species selected from Baran Dam F.R Bannu. It is logical to say that the high concentration of metals in abdomen become gradually accumulated on the sediments and in due course get transferred to fish. Present study provides new information on the concentration of heavy metals in the fish species of Baran Dam F.R Bannu. Based on sample analysis the metal concentration found in the fish samples are not in the ranged of maximum acceptable limits as per WHO. The result indicated that the heavy metal contamination definitely affected the aquatic life of different fish.

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